

## **A Simulation-based Modelling Approach for Sustainable Supply Chains through Smart Collaboration**

Gamage, D.D<sup>1</sup>, Rupasinghe, T. D<sup>1</sup>

Modelling and simulation techniques have been identified as one of the dynamic ways to analyze and deal with stochastic facets existing in a supply chain. The focus of the study is to simulate the applications of Industry 4.0 driven smart collaboration in supply chains in driving sustainability in the apparel industry. The open source agent based behavioral modelling environment, NetLogo is utilized for the aforementioned purpose. The study assesses how information sharing, sense making, resource pooling, goal congruency, empowerment and cross functionality of a smart collaborative supply chain impact on the sustainability of the apparel supply chain. The model outlines how levels of integration of each of the characteristics affects the sustainability of the supply chain. A qualitative outcome was achieved through a mixture of qualitative and quantitative survey on the carbon footprint of the agents of apparel supply chain with the variation of level of collaborative characteristics. The results were included in to the simulated environment to identify how different levels of supply chain collaboration with Industry 4.0 application impact the sustainability of the apparel industry. The scenarios clearly show that the increasing levels of Industry 4.0 applications used in supply chain collaboration results in improved sustainability performance in the apparel industry, and that the dimension of communication, coordination and cooperation contribute individually in driving sustainable Industry 4.0 with collaborative supply chains. Furthermore it proves that each of the three collaborative dimensions are important in striving towards a sustainable industry.

**Keywords:** Agent-based simulation, smart collaboration, sustainable supply chains

---

<sup>1</sup>Department of Industrial Management University of Kelaniya., Sri Lanka \*darshathagamage@gmail.com